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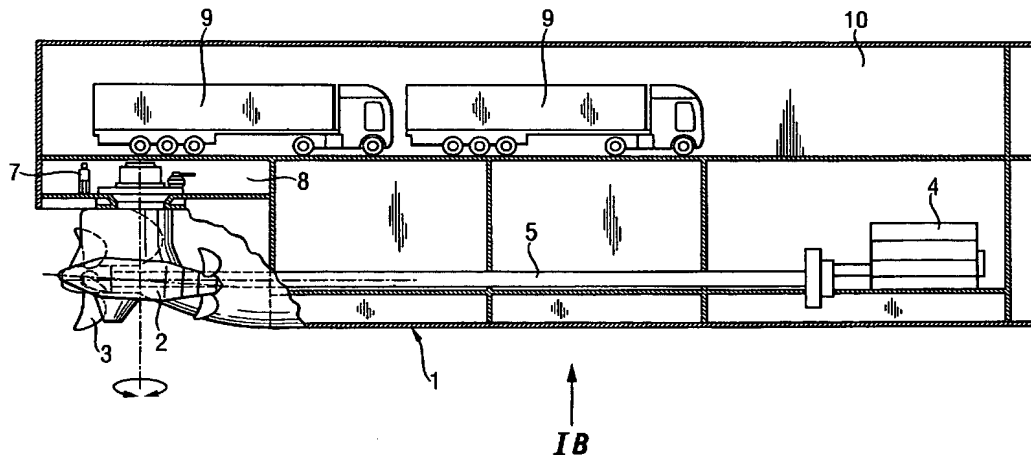
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: AN ARRANGEMENT FOR STEERING A WATER-CRAFT



(57) Abstract: The invention relates to an arrangement for steering a water-craft (1), which comprises at least one main propulsion device (3, 3a, 3b, 11, 11a, 11b, 11c), which is arranged to push the water-craft (1) forward or backward, and a number of steering propulsion devices (2), the pushing direction of which can be changed. The steering propulsion devices (2) are arranged in the aft of the water craft (1) on both sides of the said at least one main propulsion device (3, 3a, 3b, 11, 11a, 11b, 11c) so that the steering of the water-craft (1) is continuously provided by means of the steering propulsion devices (2) without any separate rudder means of the like to be functionally connected to said at least one main propulsion device (3, 3a, 3b, 11, 11a, 11b, 11c).

## AN ARRANGEMENT FOR STEERING A WATER-CRAFT

5 The invention relates to an arrangement for steering a water-craft, which comprises at least one main propulsion device, which is arranged to push the water-craft forward or backward, and a number of steering propulsion devices, the pushing direction of which can be changed, in accordance with the preamble of claim 1.

10 Water-crafts or vessels mean here all kinds of marine vessels, like for example cruisers, passenger ships, ice breakers and different cargo ships. Arrangements are already known, in which a water-craft is provided with two mechanically connected propellers with rudders behind them, two or three separate pod-propulsion devices or a propeller, behind which there is a contra-rotating propeller in a pod-propulsion device. The last mentioned has  
15 been disclosed in a WO-publication 01/54971, in which the pod-propulsion unit has been indicated by the reference numeral 4 and the propeller by numeral 3.

20 The prior art solutions include substantial disadvantages. Firstly, the mechanical propeller arrangement has long shaft lines and shaft supports outside the hull of water-craft, which lead to a non-uniform wake field.

25 Steerable rudder-propeller devices or pod-propulsion devices have become more general in water-crafts. Since these devices are turnable, their thrust force can be utilized for steering of the water-craft.

30 A disadvantage with an electric arrangement of two or more pod-propulsion devices are the high costs, because efficient pod-propulsion devices require engine-driven generators together with their power control systems. These are expensive, heavy and large. For instance in RoRo vessels handling of cargo becomes more difficult because of the engine rooms and gaps required

by the machinery, since these are partly located above the cargo deck. This means that several disadvantageous narrow parts are formed in the cargo space, whereby the rear end of the cargo space remains narrow. The heavy electric machinery leads further to a disadvantageous location of the displacement's centre of gravity in the longitudinal direction.

In the contra-rotating pod/propeller-combination there is only one steering device, which is often considered as a disadvantage from the viewpoint of reliability.

An object of the present invention is to eliminate the drawbacks of the prior art and to provide a novel solution advantageous as to its costs and enabling, where applicable, better utilization of the cargo space of the water-craft

The aims of the invention can be achieved as is disclosed in claim 1 and in the other claims. According to the invention the steering propulsion devices are arranged in the aft of the water craft on both sides of the said at least one main propulsion device so that the steering of the water-craft is continuously provided by means of the steering propulsion devices without any separate rudder means of the like to be functionally connected to said at least one main propulsion device.

The invention is based on the use of turnable steering propulsion devices in a water-craft so that they alone provide steering and additionally they participate in moving the water-craft forward. A major part of the forward or backward propulsion is generated by a separate thrust device e.g. a large propulsion unit or large propulsion units. An important advantage of the solution according to the invention is the fact that the upper end of the pod-propulsion devices fits below the cargo deck. Since the fully electric machinery of conventional large pod-propulsion devices is heavier and larger than the machinery to be utilized according to the invention, the invention allows for increased cargo capacity and handling of cargo becomes more efficient

and easier. Furthermore, the solution is more economic and easier to put technically into practice than the known solutions. The cargo deck can be lowered, the dimensions of the water-craft can be more economic and, compared with one centre propulsion device, two propulsion devices provide better reliability, which is important especially for the manoeuvrability of a passenger ship. Further, when separate main propulsion devices and steering propulsion devices are provided no supplementary output is used unnecessarily in manoeuvring.

10 According to the invention there is an even number of the steering propulsion devices and the propeller part of the steering propulsion devices is stationarily located outside of the hull of the water-craft. There is one or more main propulsion devices and for instance a propeller or a water-jet device may function as the main propulsion device.

15 The water-craft's at least one main propulsion device is located essentially in the aft centre part of the water-craft and the steering propulsion devices are positioned to the sides of the propulsion device being thus located in the lateral parts of the water-craft near the sideboards thereof. A high efficiency is  
20 obtained when the main propulsion device is placed as far as possible in the water-craft's aft and no protruding parts increasing the resistance are needed in the rear side of the main propulsion device. Since no shaft bearings are needed, a uniform wake is created. The steering propulsion devices provide an excellent manoeuvrability even in rough weather conditions, also at low  
25 speeds for instance less than 5 knots.

According to the invention, the output of the steering propulsion devices need not be high. The output required by the steering propulsion devices is less than 50% of the common shaft output of the main propulsion device  
30 and of the steering propulsion device. Shaft output means here the usual output obtained from the devices at maximum i.e. the nominal output taken by the main propulsion device and the steering propulsion device, which can

be measured from the outlet shaft of the device. The propulsion device itself is connected by means of a horizontal or almost horizontal shaft or shafts to a prime mover that may comprise one or more diesel engines and/or electric engines and/or gas turbines.

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Further, since the steering propulsion devices are installed on both sides of the one or more main propulsion devices substantially near the outboard of the water-craft, they can be relatively small and can thus be installed under the cargo space of the water-craft. By doing so, a space can be formed under the cargo space for the maintenance and inspection of the steering propulsion devices.

Also other alternative solutions are conceivable, in which there can be in the middle one or more water-jet devices as a main propulsion device e.g. if the speed of the water-craft is high. Also in this case, the steering propulsion devices are at the side and a major part of the power used for moving forward is provided by the main propulsion device.

In the following the invention is described by way of example only with reference to the accompanying drawings, in which

- Figures 1A and 1B show a water-craft provided with an arrangement according to the invention as a side view and viewed from below,
- Figures 2A and 2B show alternative solutions relating to main propulsion devices and steering propulsion devices, and
- Figures 3A and 3B show further alternative solutions relating to main propulsion devices and steering devices.

According to Figures 1A and 1B, the arrangement is formed by a water-craft or a vessel 1 together with steering propulsion devices 2 and a main propulsion device 3. In this solution, the steering propulsion devices, even in number, have been placed quite close to the outboard 6 of the vessel. Diesel engines, indicated by the reference numeral 4, serve as prime mover for the

main propulsion device, the output of which is transferred to the main propulsion device by means of a shaft 5. As the steering propulsion devices in the solution according to the invention need not be large, they do not require much space and the maintenance space 8 they need, in which maintenance staff 7 may go for checking, and when required, repairing the steering propulsion devices, is situated advantageously below the cargo space 10. In this way the whole cargo space can be put into use and there are no previously needed narrowing parts, but the whole area can be utilized at maximum e.g. by loading onboard trucks and other cargo on wheels 9.

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In Figure 2A, the upper view shows a main propulsion device 3 and a steering propulsion device 2. Furthermore, a couple of examples of a steering propulsion device is shown in different positions 2a and 2b. When the steering propulsion device is in position 2b, turning of the vessel into a desired direction is provided. If there is a need for boosting the turning, also the other steering propulsion device 2 is turned, respectively, into position 2b simultaneously with the previous one. In Figure 2B, one main propulsion device 3 has been replaced by two separate main propulsion devices 3a and 3b.

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In Figure 3A, in addition to the steering propulsion devices 2, there is provided an alternative solution to the traditional propeller and in this view a water-jet device 11 is used as a main propulsion device. The Figure 3B view is a supplementary variation of the Figure 3A, in which there are more than one water-jets, in this solution three water-jets 11a, 11b and 11c. Advantageously, also two water-jets 11a and 11c can be installed.

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Within the scope of invention, solutions also differing from the above described are feasible. The solution can be applied to all kinds of water-crafts. For example, in war ships and cruisers the solution makes possible a diversified driving profile. The main mover of the steering propulsion devices can also be placed above the cargo deck e.g. around the smoke stack, in which case supplying of electricity also to other parts of the vessel is easy. In cruis-

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ers, this makes possible flexible distribution of electric power between the hotel load and the propulsion devices.

5 It is clear to the one skilled in the art that the invention is not restricted to the embodiments described above, but different applications thereof are feasible within the inventive idea defined by the ensuing claims.

## CLAIMS

1. An arrangement for steering a water-craft (1), which comprises at least one main propulsion device (3, 3a, 3b, 11, 11a, 11b, 11c), which is arranged to push the water-craft (1) forward or backward, and a number of steering propulsion devices (2), the pushing direction of which can be changed, **characterized** in that the steering propulsion devices (2) are arranged in the aft of the water craft (1) on both sides of the said at least one main propulsion device (3, 3a, 3b, 11, 11a, 11b, 11c) so that the steering of the water-craft (1) is continuously provided by means of the steering propulsion devices (2) without any separate rudder means of the like to be functionally connected to said at least one main propulsion device (3, 3a, 3b, 11, 11a, 11b, 11c).
2. An arrangement according to claim 1, **characterized** in that there is an even number of the steering propulsion devices (2) and the propeller part of the steering propulsion devices (2) is stationarily located outside of the hull of the water-craft (1) .
3. An arrangement according to claim 1 or 2, **characterized** in that a propeller (3, 3a, 3b) or a water-jet device (11, 11a, 11b, 11c) functions as the main propulsion device.
4. An arrangement according to any of the preceding claims, **characterized** in that the at least one main propulsion device (3, 3a, 3b, 11, 11a, 11b, 11c) of the water-craft (1) is located essentially in the aft centre part of the water-craft (1) and the steering propulsion devices (2) are located essentially in the lateral parts of the aft of the water-craft (1).
5. An arrangement according to any of the preceding claims, **characterized** in that the output required by the steering propulsion devices (2) is in all less than 50% of the common shaft output of the said at least one main propul-



sion device (3, 3a, 3b, 11, 11a, 11b, 11c) and of the steering propulsion devices (2).

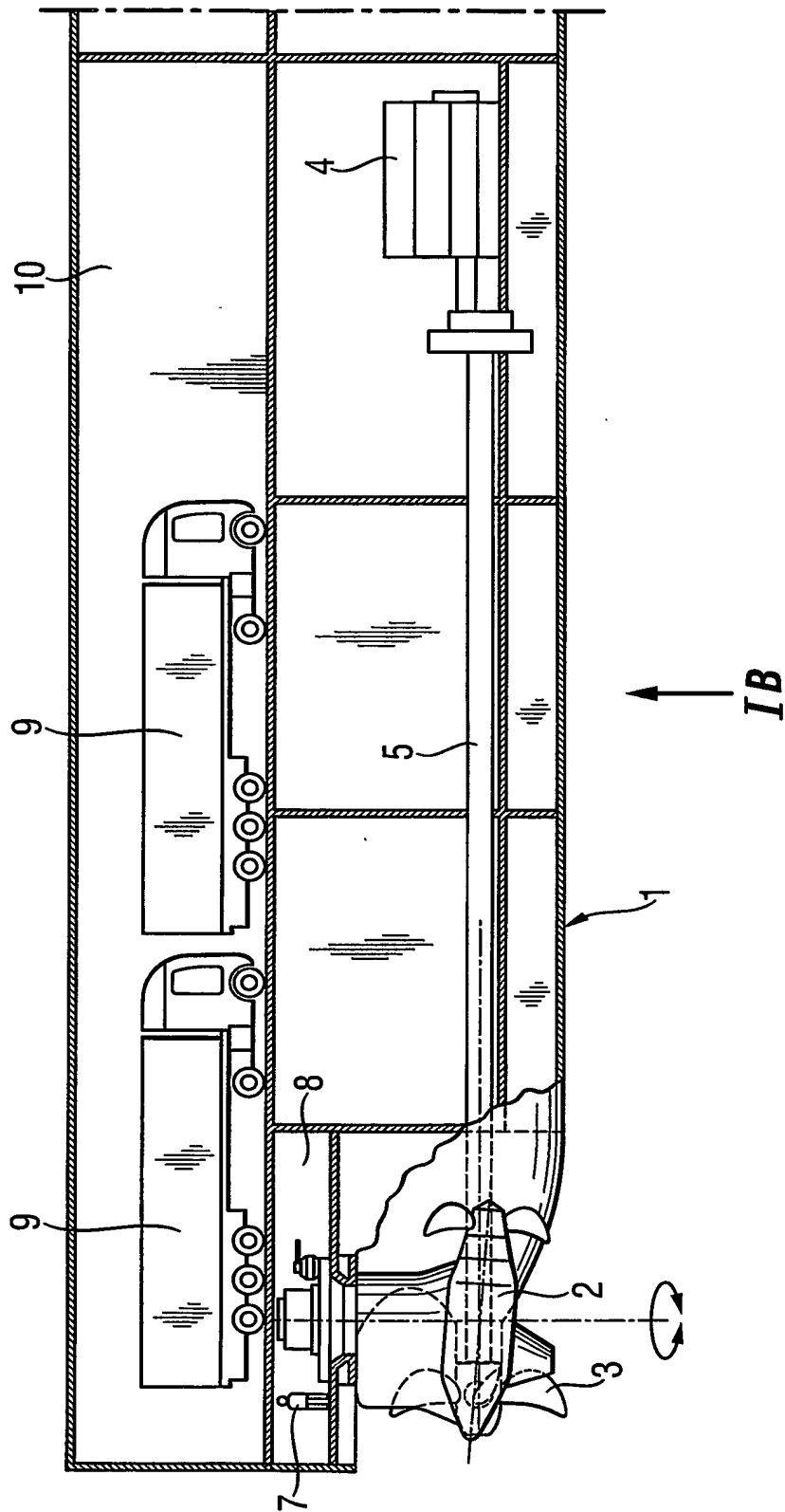
5 6. An arrangement according to any of the preceding claims, **characterized** in that said at least one main propulsion device (3, 3a, 3b) is connected by means of a shaft (5) to a prime mover (4), which prime mover (4) can be e.g. one or more diesel and/or electric engines and/or gas turbines.

10 7. An arrangement according to any of the preceding claims, **characterized** in that the steering propulsion devices (2) are arranged to be installed under the cargo space (10) of the water-craft (1).

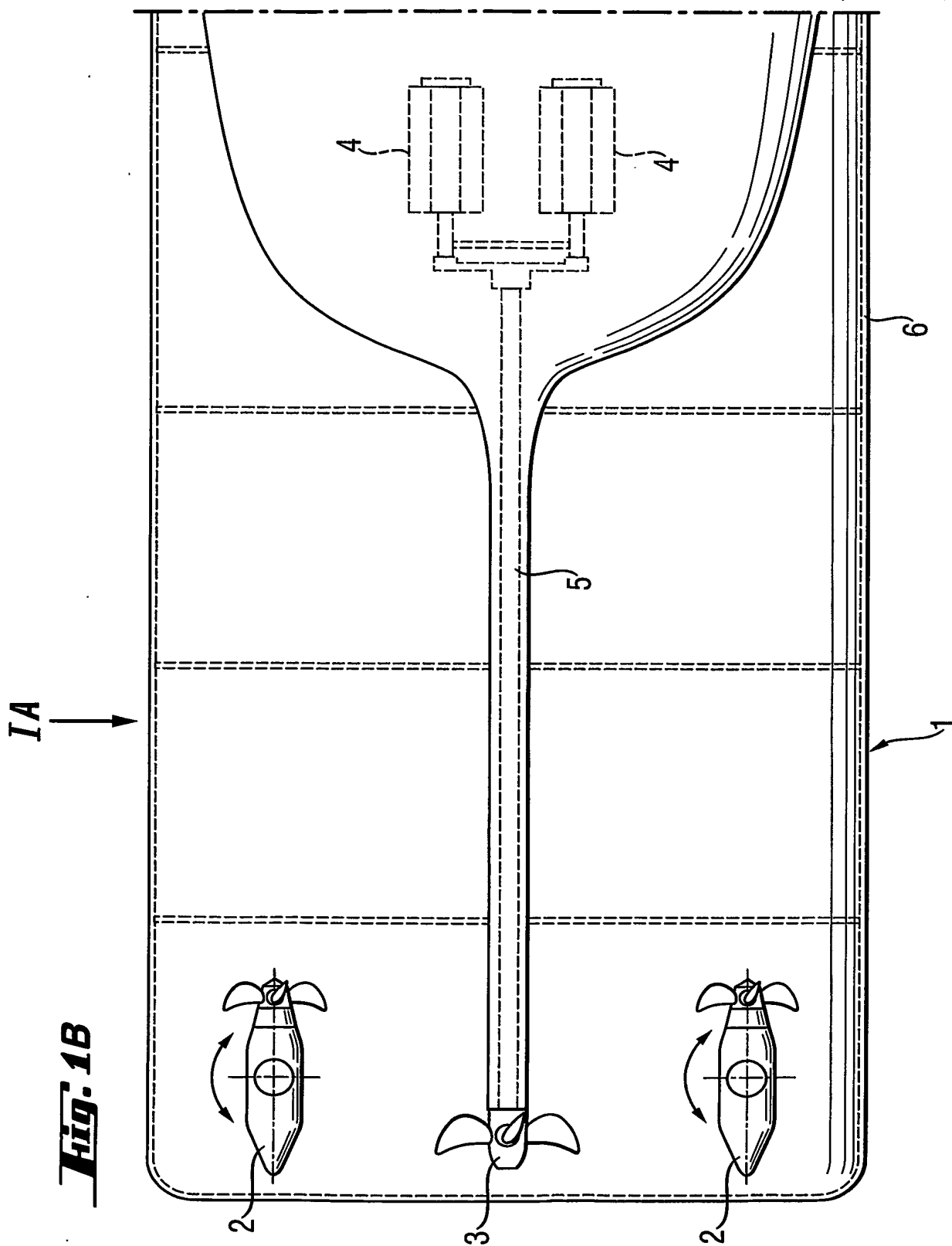
15 8. An arrangement according to claim 7, **characterized** that the steering propulsion devices (2) are arranged to be installed to the water-craft (1) so that a space (8) is formed under the cargo space (10) for the maintenance of the steering propulsion devices (2).

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**Fig. 1A**

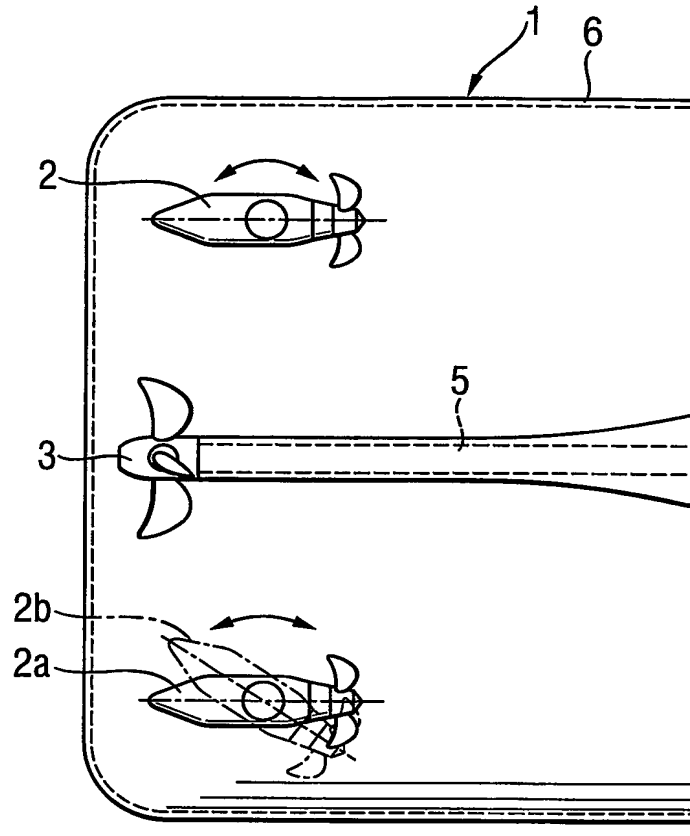


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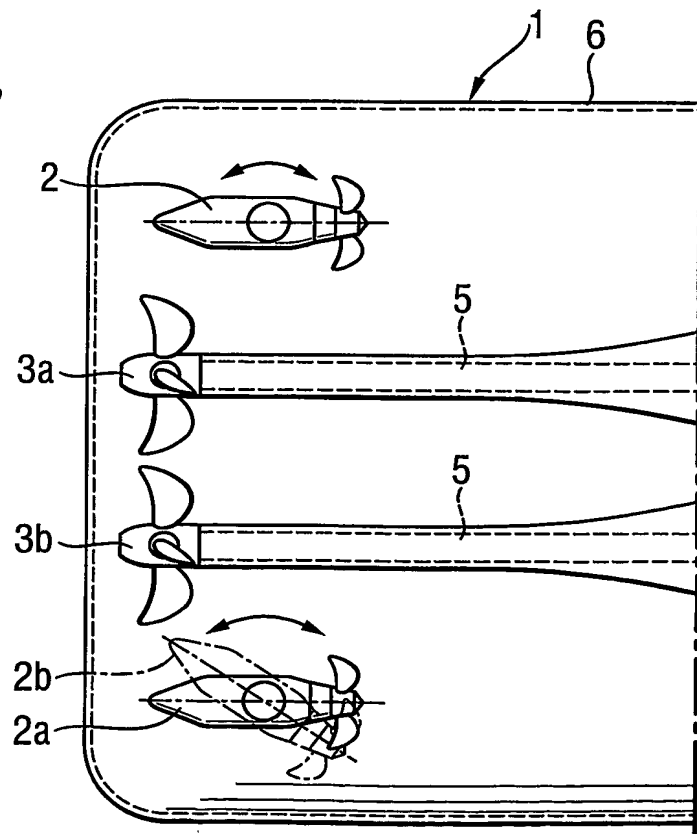


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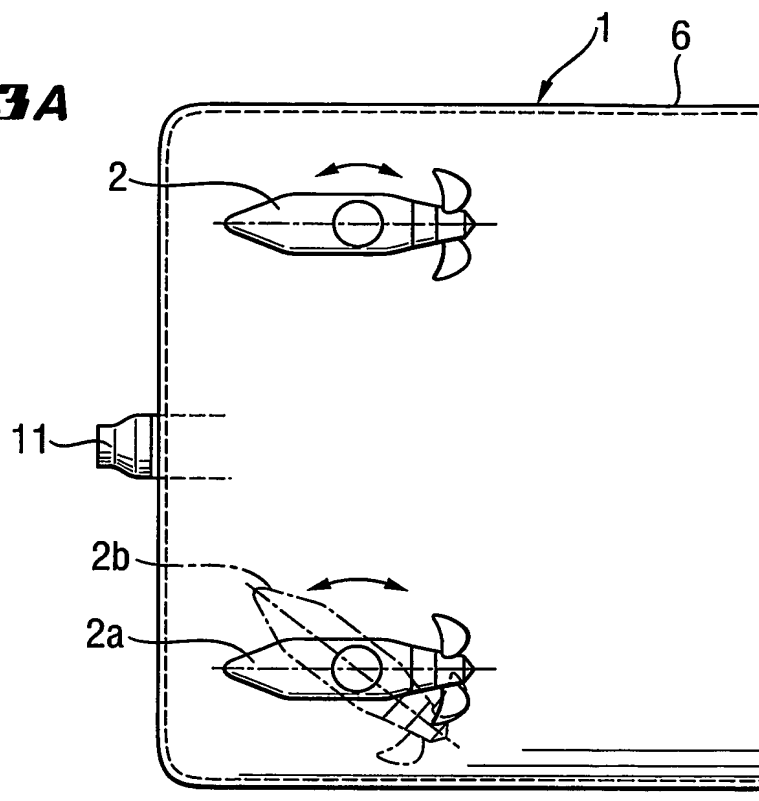
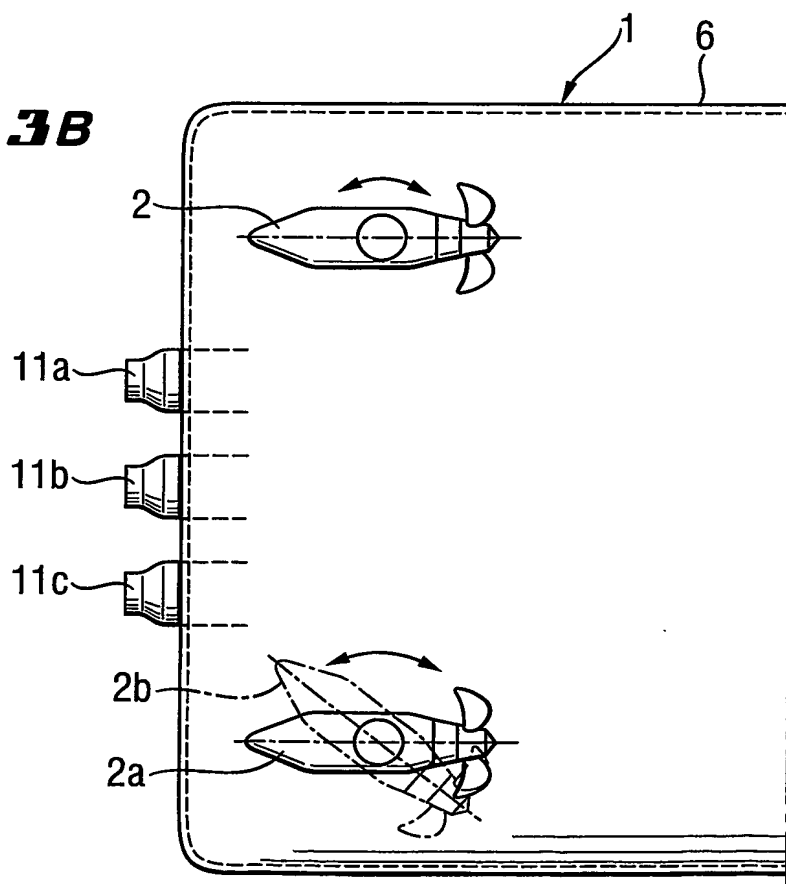
**Fig. 2A**



**Fig. 2B**



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**Fig. 3A****Fig. 3B**

## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/FI 03/00018

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B63H 25/42, B63H 5/08

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B63H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 9142391 A (MITSUBISHI HEAVY IND LTD), 3 June 1997 (03.06.97), figures 1,2, abstract	1,2,4-8
A	--	3
X	PATENT ABSTRACTS OF JAPAN vol.1997, no.10 31 October 1997 (1997-10-31) & JP 9142391 A (MITSUBISHI HEAVY IND LTD) 03 June 1997 (1997-06-03) abstract	1,2,4-8
A	-- -----	3

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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